

OBSERVATIONS ON THE BIONOMICS AND FISHERY OF THE BROWN MUSSEL (*MYTILUS* SP.) OF THE CAPE REGION OF PENINSULAR INDIA¹

BY

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(With a text map and two plates)

(Communicated by Dr. S. L. Hora)

INTRODUCTION

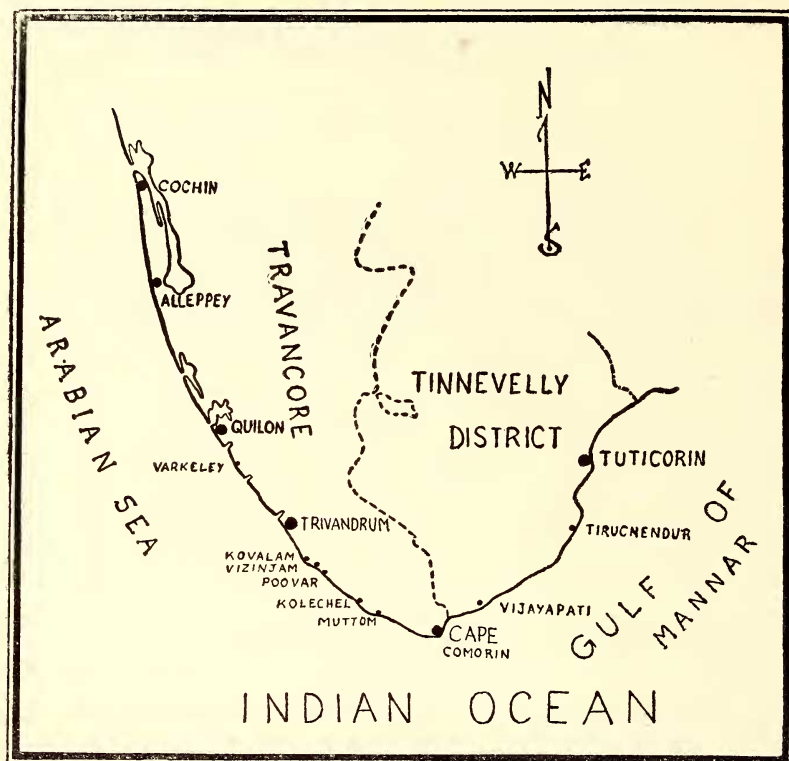
Brown Mussel fishing is a regular industry of considerable local importance along the rocky coastal tracts of Southern Travancore and the Tinnevely District of Madras Province. From Kovalam near Triyandrum up to Cape Comorin, the 'Land's End' of India, along the west coast, and beyond as far as the Tinnevely District on the east coast, the sea shore consists of frequent stretches of rock with intermittent beaches of sand. Several fishing villages nestle along these beaches and some as at Vizhinjam, Pulluvila, Poovar, Thengapatnam, Midalam, Kolachal, Muttam, Manakudi, Cape Comorin and Leepuram are very large ones, each consisting of hundreds of families carrying on inshore, foreshore and to some extent offshore fishing with country boats and catamarans. The fairly close proximity of the Wadge Bank to this area gives a rich yield of fish to the enterprising fishermen and in comparison to this, the value of the Brown Mussel fished is not great. Despite this, Brown Mussel fishery plays an important part in the economy and dietary of quite a large number of people along the coast since, in addition to giving employment with a modest income to several hundreds of people for about 6 to 8 months in the year, thousands are benefited by the availability of a very nutritious and palatable article of diet as an alternative to ordinary fish especially during the months when the latter is scarce.

Brown Mussel is known as 'chippi', 'muthuva' or 'muthuvachippi' in Malayalam² and as 'kallika' and 'kadalka' in Tamil. It is no exaggeration to say that it is a food of the greatest delicacy to those accustomed to it and it is even said that some develop almost a sort of craving if unable to get it for a long time. About a quarter of a century ago this was popular only amongst the poorer and backward classes whereas now it is liked by all the fish-eating people including many among the high-castes so much so that during the season when the mussel is in prime condition there is practically a scramble for it as soon as it is brought to the shore. Some of the poor people when they go on a visit to their relatives living in the

¹ Observations mainly relate to the conditions on the West Coast. The article was prepared in 1947 and finalised after the author joined the Central Inland Fisheries Research Station, Barrackpore.

² In Malabar the Green Mussel is known as 'Kallumalkai' and the small sized young stages are known as 'Kadukka'.

interior of the country take a quantity of mussel and bring back in return with them cassava or tapioca (*Manihot utilisima*) roots.



The Cape region of peninsular India, showing the important Brown Mussel fishing centres in South Travancore.

DISTRIBUTION AND SYSTEMATICS

Regarding the distribution of the Brown Mussel, so far as the writer knows, it is confined to the South Travancore and Tinnevely coasts. The Green Mussel is only occasionally seen in South Travancore but its abundance increases from the Cape towards the Tinnevely side. Both the Brown and Green Mussels have been collected from Varkaley between Trivandrum and Quilon. Only the latter species was collected by the writer from the piles of the pier at Alleppey Port in North Travancore, and the Madras Harbour, and Pamban near Rameswaram and also from the Colombo Harbour. Reasons for the restricted distribution of the Brown Mussel are not known.

Our present knowledge about the biology and fishery of the Brown Mussel is mainly confined to the brief remarks of Hornell (1917 & 1921) in his accounts of the 'Edible Molluscs of the Madras Presidency' and the 'Common Molluscs of South India' respectively. Rao (1941), presumably basing his observations on Hornell's account, refers to the fishery of Brown Mussel in general terms.

Dealing with the Green and Brown Mussels Hornell¹ (1947) says as follows:—'One of these is the very handsome Green Mussel (*Mytilus smaragdinus* Chem.) readily recognised because of the handsome green coloration of the horny membrane of periostracum investing the surface of its valve; the other is an even larger species, less elegant in contour, coated with a coarse brown periostracum that looks commonplace when contrasted with the vivid tint of the green. The former species is distributed widely upon the Madras coast extending as it does almost continuously from South Kanara on the west coast to the borders of Orissa on the east. The brown form, on the other hand, is confined so far as I am aware to the extreme south of Travancore and of the Tinnevely District'.

'This mussel', he writes, 'is the largest and the stoutest species found in South India attaining commonly a length of 4 inches. It is distinctly larger than the Green Mussel, but unlike the latter its distribution is limited to a comparatively short length of coast in South Travancore, where it displaces the green species. The coast there is exposed to exceptionally heavy seas during the monsoons but in spite of this it thrives in great abundance on rocks from low tide to a depth of about $2\frac{1}{2}$ to 3 fathoms. Annually large quantities are taken from the rocks by divers. They form an important food item among fishermen and coast Muhammadans'.

It is unfortunate that there is no information about the quantity fished from the coasts of Tinnevely and South Travancore though thousands of maunds (gross weight) are collected every year. In the latest fish marketing survey report² there is also no record of the collections.

BIONOMICS

The Brown Mussel thrives well on firm, clean substratum, to which the anchoring threads or byssus are firmly attached. The surface of the rock should be devoid of algal growth or sand for the spat to take hold and develop into mussel. Complete submergence and clear water, with as little suspended impurities as possible but with plenty of food and light, are ideal conditions for its proper growth. It is known to thrive up to a depth of about 20 feet. Specimens subjected to waves carrying sand get easily choked by the latter and perish.

The breeding season of the mussel appears to be extended, but the main peak period is from June to August (Plate I, 2.) during the monsoon months when the sea is rough and advances considerably on to the shore. The rocks in the littoral region, which in summer were exposed, get covered by the sea which is so rough that a natural close season is established. Clusters of the mussel appear in almost all the clean submerged portions of the rocks. There is a secondary spurt of breeding during October and November, but the intensity of which

¹ In Hornell's recent 'The Study of Indian Molluscs' (*J. Bombay Nat. Hist. Soc.*, 48 (3), 1949, p. 562) he gives the same information except that he calls the Green Mussel, *Mytilus viridis* L. It is rather strange that the specific name still remains unknown.

² 'Report on the Marketing of Fish in India.' Delhi. 1946.

could in no way be compared to that of the first season. The mussels from the June-August spats do not become sexually mature by October-November to bring about the second spat formation.

THE FISHERY OF THE BROWN MUSSEL

The fishing season commences in September after the southwest monsoon when the sea becomes calmer and water begins to recede. The rocks in the littoral region that were covered by the seas gradually get exposed showing a dark brown carpet of young *Mytilus* (Plate III, 1.). The receding sea continues to send frequently waves which sweep over its former domain and help to keep the mussels alive. The fishing is at first confined to the rock pools (Plate II, 2.) and little baylets from where the fishermen collect the mussel cautiously retreating to the safer and higher ground whenever high waves sweep over the place. The less venturesome old men, children and some women make collections from the semi-exposed beds. Mussels from such situations being mostly half-starved are in little demand by the public and are usually taken by the collectors for their home consumption. As weeks go on, the sea recedes considerably and the men enter the sea for regular collection (Plate I, 3.). The regular fishing season is from mid-November to April-May. From December onwards large specimens of mussel known as *muthuva* or *muthuvachippi*¹ (Plate I, 1.) which are the survivors of the previous year's brood, become available and the crop increases both in quality and quantity by January and February. This is usually in such prime condition that the demand is very high. It has been found that for some inexplicable reasons the mussel sometimes grow 'lean' and lose their 'condition' (Plate I, 1.).

It appears that the condition of the gonads is mainly responsible for the fat and lean condition of the mussel, and as Kesteven (1941) says in the case of oysters this 'may be determined by a complex interaction of biological rhythms and water conditions'. This is a matter that requires elucidation in the case of our mussels. Some say that the phenomenon locally known as 'kara' (which means 'milk' or 'sap') in the sea is responsible for this, while some others say that after the 'kara' the mussel gets into good condition. Whatever be the cause the mussel is in good condition between two 'karas'! It is said that when this phenomenon happens water loses its clear transparency and turns somewhat turbid and the men do not generally enter the sea at this time since it would irritate the eyes. The sea water examined by the writer three days after a case of 'kara' was reported showed a large quantity of *Noctiluca* in it. 'Kara' usually occurs from February to April².

¹ 'Muthu' means pearl and as such '*muthuvachippi*' means pearl-bearing mussel.

² The general belief is that in December to February, which is the season of the ripening of the tamarind fruit, the mussel grows lean and with the flowering of the dadap (*Erythrina indica*) which is in about April the flesh becomes fat, developing a pinkish colour. These are of course only seasonal coincidences.



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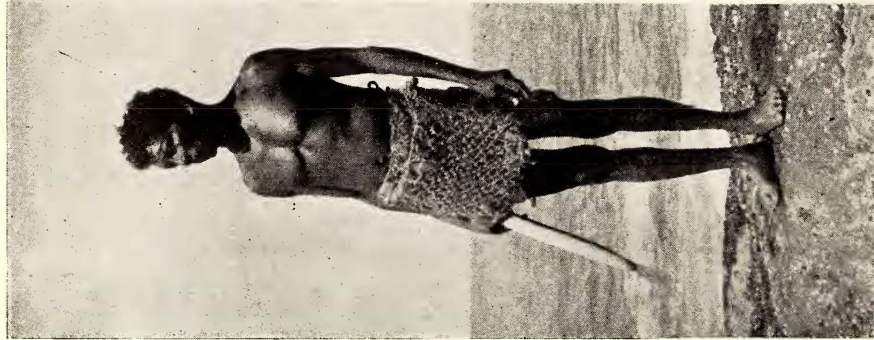


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Photos by

For explanation see p. 528

Author



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In the northern section between Poovar and Kovalam, fishing is done mainly by Pulayas¹. These people do not belong to the true fishing communities like the Mukkuva (Christian), the Nulaya or Araya (Hindu) and the Marakkan (Muhammedan). Apart from shell-fishing and conch-fishing some Pulayas have taken to line fishing mostly when there is no mussel fishing. It is a great advantage to these people that the main agricultural operations are done during and between the south-west and north-east monsoons when shell fishing is rather difficult and is rarely done. In places south of Poovar, this fishing is mainly done by the Mukkuva or the Christian fishermen.

The fishing implements (Plate II, 1 & 4.) are very simple consisting of a coir bag known as *maal* and a large blunt chisel known as *uli*². The *maal* is nothing but a crude rectangular close-meshed coir bag about $1\frac{1}{2}$ ft. long and 1 ft. broad with two small coir ropes on either side so as to enable it to be tied on to the waist. *Uli* is a crude chisel consisting of a stout softwood handle about 18 inches long and about $1\frac{3}{4}$ inches in diameter with a blunt edged iron blade about 3 inches wide. The basal portion of the blade which is narrow and tapering is driven into the handle and is fixed tightly by an iron hoop. The handle is shaped out mostly by the men themselves in their spare time from softwoods like dadap (*Erythrina indica*) or silk cotton (*Bombax malabaricum*). In water it floats with the blade end down and the handle up and the buoyancy of the *uli* prevents it from being lost. In South Canara and Malabar coasts any hardwood sharpened at both ends is used for the collection of Green Mussel, whereas on the Bombay coast according to Rai (1932) an iron chisel is used for the purpose.

During the later part of the fishing season of the brown *Mytilus* the men have to go off the shore, usually in catamarans (Plate III, 2) and the fishing appliances are the same except that the *maal* is a very large one known as 'kottumaal' or foldable bag which is kept on the catamaran.

Attired in a scanty loin cloth the fishermen tie the *maal* in front at the waist and with the *uli* in hand (Plate II, 1.) jump into the water. The men are good divers and sturdy swimmers and are capable of remaining in water for quite a long time.

Before getting into the sea the fisherman makes a quick gesture of 'namaskaram' for heavenly protection and at the correct time when the wave heaves back he dives into the water. Combined with the pull of the sea and his own efforts he soon finds himself beyond the danger zone (Plate I, 3.). He dislodges the mussels from the submarine beds with his *uli* and fills the *maal* occasionally coming up to the surface to breathe. Getting back to the rocks with the heavy load of mussel is a very difficult task. He waits at the border zone and, at the correct interval between two swells, clambers up the slippery

¹ Pulayas, also known as Cherumas, have been defined 'as a Malayalam caste of agricultural serfs and as members of an inferior caste in Malabar, who are, as a rule toilers attached to the soil' (E. Thurston: 'Castes and tribes of Southern India', Vol. II. p. 45.)

² The pre-war cost of an *uli* was about 8 annas and a *maal* about 6 to 8 annas.

and precipitous rocks with the left hand supporting the mussel-filled *maal* (Plate I, 4.). The fishing is usually done from about 9 or 10 o'clock in the morning to about 2 or 3 in the afternoon. A bright sun and a clear sea are essential for this purpose. No fishing is attempted when it is raining or when the sea is very rough or when there is *kara* which causes considerable irritation to the eyes. The tidal effect is not much in these parts and tides do not appear to play a decisive part in the fishing operations though diving is more convenient at low water. Spring tide period is generally avoided.

Gradually the submerged rocks close to the shore get depleted and the men swim further out in search of fresh grounds. As this becomes more tiresome by the increase in distance, three or four men co-operate and hire out catamarans if they do not have their own, which serve as a temporary advance base for their operations (Plate II, 3.). In some parts, especially in the far south, the fishermen have their own catamarans. Here the catches are mostly landed on the beach where customers gather for the purchase of the mussel. Catamaran fishing of distant beds is common near Vizhinjam, Muttam, Kolachal and Kanyakumari (Cape Comorin) where there are certain rocks, like Kulathunkal, Adumechanpara, Keekal, Melekkal and other places, away from the shore.

In the course of *Mytilus* fishing certain subsidiary catches are also brought up. They consist of a species of *Purpura* which is one of the common edible marine gastropods in these parts. Some call it 'Kalchank' meaning rock gastropod to distinguish it from other chanks. This is in good demand and as compared to the pre-war price of 2 annas per hundred now fetches 8 to 12 annas. Lobsters (*Panilurus* sp.) are also sometimes caught and now fetch 8 to 12 annas each according to the size. This is about 4 to 6 times the pre-war price. Occasionally they bring up the sea urchin, *Stomopneustes* sp., as well, the gonads of which are considered delicious and consumed raw by the fishermen.

Sales:—Most of the sales of the Brown Mussel are effected on the rocks or at the shore soon after the mussel is landed (Plate II, 4.). The men seldom carry away the stuff for sale, but dispose them off immediately to the consumers and retailers, the latter conveying them to the neighbouring markets for sale. When the mussels are brought ashore by the fishermen they are mixed up with an amount of empty shells, barnacles and weeds and the cleaning up and sorting of the good ones is usually done at the spot.

Prices:—There is considerable difference between the present (1947) and pre-war prices.

Pre-war price of a bag (<i>maal</i>) of small mussel				$\frac{1}{2}$ —1 anna.
Present	"	"	"	3—4 annas.
Pre-war	"	"	100 large mussel	2—3 "
Present	"	"	100 " "	12—14 "

The average earning of a fisherman on a day's fishing before the war was about 6 annas whereas now it is about Rs. 2 and sometimes even more.

Shells:—An important by-product of the industry is the shell which fetches good price for the manufacture of lime. The dead and rejected

shells left on the shore at the time of sorting are also utilized for the purpose. Some use the shells for manuring the coconut farms. As Hornell (1921) says in the case of Green Mussel in Malabar, kitchen middens of discarded shells of Brown Mussel are quite a common sight behind houses in the coastal tracts of South Travancore. They are either sold to lime burners or used as manure in gardens.

Pearls:—Pearls are occasionally found in the large sized shellfishes and these vary in size from a tiny pin-head to that of a peppercorn (the largest the author has seen) in very exceptional cases. No one searches for the pearl and there is no trade in it. When cooked *Mytilus* is eaten, the 'pearl bite' could be distinguished from a 'sand bite' by the hardness of the former. There is a common belief among the local people that a pearl is killed when boiled whereas, a pearl from a live mussel would continue to grow if thrown back into the sea or if kept in a vessel of clean sea water.

Methods of consumption:—The tuberous root of tapioca or cassava cut into fairly large sized pieces, 1 to 3 inches in length, are put in an earthen cooking vessel with a little water for boiling. Over the roots the shellfish are kept and boiled. By the time the roots are cooked the shellfish also get cooked. After draining off the water the members of the family sit around and eat (Plate III, 4.). Saltwater from the mussel imparts sufficient taste to the roots and effects economy of salt, and cooking both together saves time and firewood and obviates the necessity for two vessels. A large number of the poorer classes consume mussel in the above manner.

Some boil the shellfish and eat the flesh by itself or with rice or cassava root. Sometimes the raw flesh is removed and prepared as a separate dish.

The raw mussel flesh is relished by some (Plate III, 3.), but it is seldom consumed thus as a regular item of food. Only the poorer classes are accustomed to it.

Though the drying of mussel is not at all in vogue, the writer has experimented on sun-drying of boiled as well as fried mussel meat. Both could be sun-dried and the stuff is very tasty and keeps well for a number of days. In this connection the findings of Humphrey (1941) in the case of the Australian Rock-oyster that it could be dried without significant loss of glycogen and protein are of interest. It is quite likely that this may be the same with our marine mussels¹ in which case they could be dried with advantage if and when heavy crops become available.

Associated animals:—Though on the surface of the shell it is common to see various kinds of sedentary and free living marine organisms, an interesting feature is the presence of a tiny crab, *Pinnotheres* sp., which somehow or other finds comfortable shelter inside. In view of the protection derived the necessity for a shell within a shell is obviated. It is very soft bodied and females are much more

¹ The writer could not find any record as to the nutritive value of the mussels of the Indian waters. His efforts to get the meat of the Brown Mussel analysed failed since the Nutrition Research Laboratory, Coonoor, could not undertake the examination of the mussel sent by him.

commoner than the males which are only rarely met with. The former develops a pinkish tint when filled with gonad and though small is tasty. Similar crabs have been found in the Rock Oyster, *Ostrea cucullata*, but their specific position is also not known¹.

GENERAL REMARKS AND SUGGESTIONS

Though the Brown Mussel fishery is at present limited to the Cape region of peninsular India the contribution it makes towards the diet of the nation especially at a time when fish is scarce is of great significance. A higher yield of mussel helps indirectly to divert more of other fish from the coastal area to the interior markets. Despite this there is little data regarding the mussel fishery and from the reports of the various Fishery Departments it could be seen that the attention paid to it is very little.

This is one of the few fisheries in India wherein considerable degree of augmentation of production by more intense and judicious exploitation is possible with minimum expenditure. What is required is a practical approach to the problem after acquiring a thorough knowledge of the existing conditions. At present the following points require further consideration:—

1. Whether the Brown Mussel is overfished or underfished?
2. Do the fishing methods require improvement?
3. What measures are necessary for the increased output of the mussel?

The answer to the first question is definitely that far from being overfished the mussel is underexploited. Years of general observation show that apparently there is no depletion of the brood stock, and that year after year the littoral and fishable rocks get replenished with mussel spat from inaccessible beds. Though it has been said that the mussel is not overfished so as to cause the depletion of the brood stock it may be stressed here that considerable quantity of undersized shellfish is taken out during the early part of the season contributing towards the depletion of the accessible beds.

A general complaint that one hears from the fishermen is that the quantity fished by an individual now is less than in previous years in spite of increased time and labour spent. While the area fished and the quantity of crop have remained more or less static the number of fishermen has increased resulting in a decrease in per capita production. As already stated, the position regarding the fishable areas is rather disquieting. Though the removal of undersized specimens from crowded beds might be helpful in thinning them out and facilitating quicker growth, large scale removal reduces the number of survivors as a result of which considerable time and labour are wasted in search-

¹ Members of the genus *Pinnotheres* are well known as dwellers inside bivalves. The identification of the different species of *Pinnotheres* is rather difficult and this was not attempted. For recent records of *Pinnotheres* spp. from the Indo-Pacific region see Tesch (1918) 'The Decapoda Brachyura of the Siboga Expedition, II Gonoplacide and Pinnotheridae' [Siboga Expedition, Part LXXXV Monograph 39 C, pp. 149-295, De Ma, J. G. 1929, Bijdr. Dierk., (Amsterdam), and Isabella Gordon, 1936-39, Journ. Linn. Soc., London. XL.]